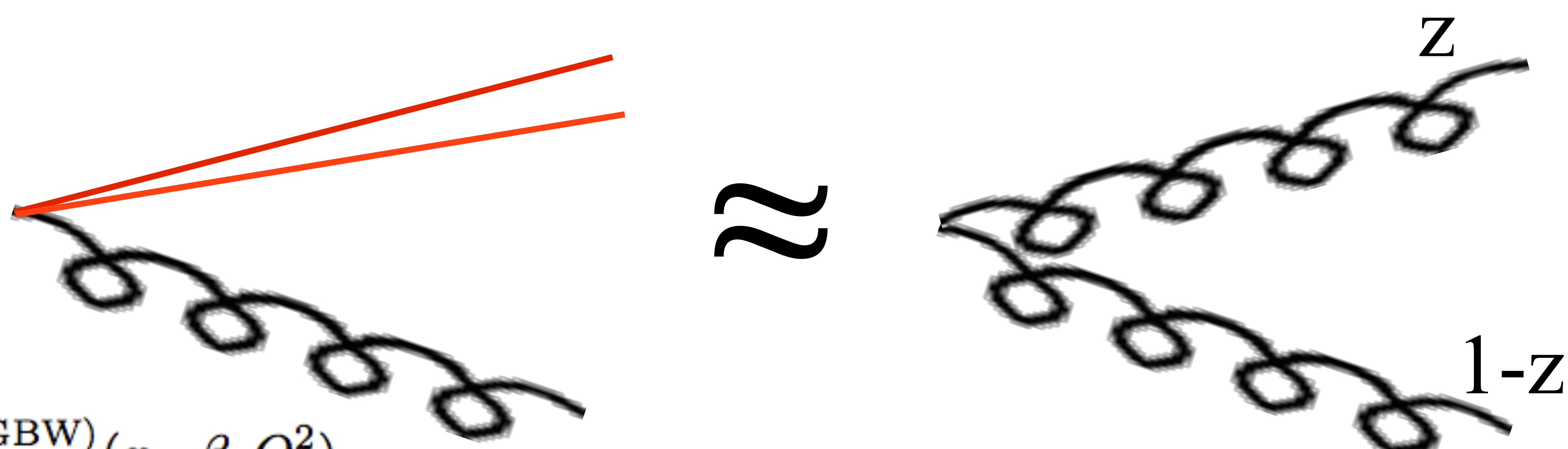
Implementing qqg

qqg-part one: GBW

Large Q2 limit: quarks close together.
qqg is approximated by a gg



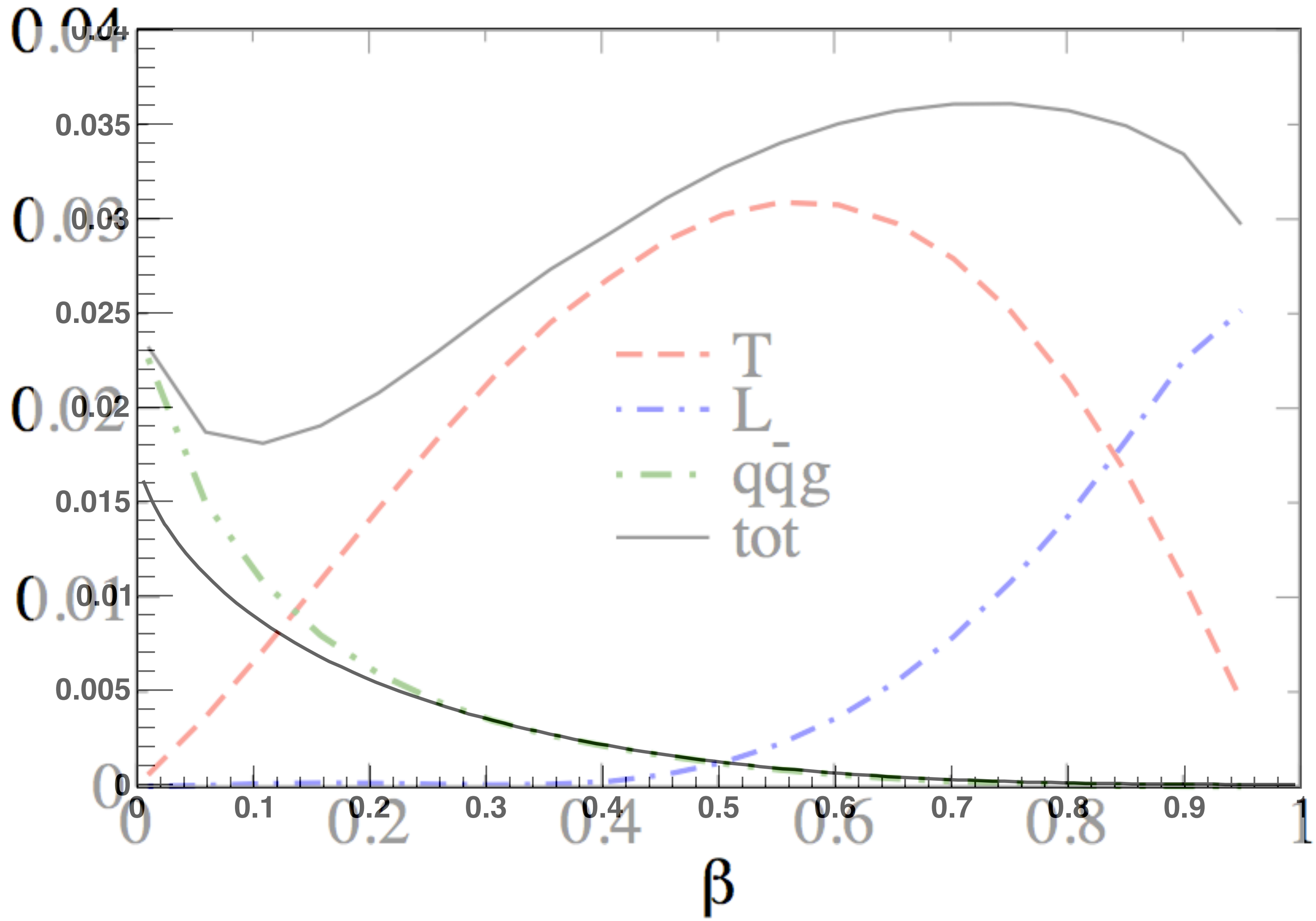
$$x_{\mathbb{P}} F_{T,q\bar{q}g}^{\mathrm{D\ (GBW)}}(x_{\mathbb{P}}, \beta, Q^2) =$$

$$\frac{\alpha_{\mathrm{s}}\beta}{8\pi^4} \sum_f e_f^2 \int \mathrm{d}^2\mathbf{b}_T \int_0^{Q^2} \mathrm{d}k^2 \int_\beta^1 \mathrm{d}z \Bigg\{ k^4 \ln\frac{Q^2}{k^2} \left[\left(1-\frac{\beta}{z}\right)^2 + \left(\frac{\beta}{z}\right)^2 \right]$$

$$\times \left[\int_0^\infty \mathrm{d}r r \frac{\mathrm{d}\tilde{\sigma}_{\mathrm{dip}}}{\mathrm{d}^2\mathbf{b}_T}(\mathbf{b}_T, \mathbf{r}_T, x_{\mathbb{P}}) K_2(\sqrt{z}kr) J_2(\sqrt{1-z}kr) \right]^2 \Bigg\}$$

qqg-part one: GBW

Does not behave well for very small β

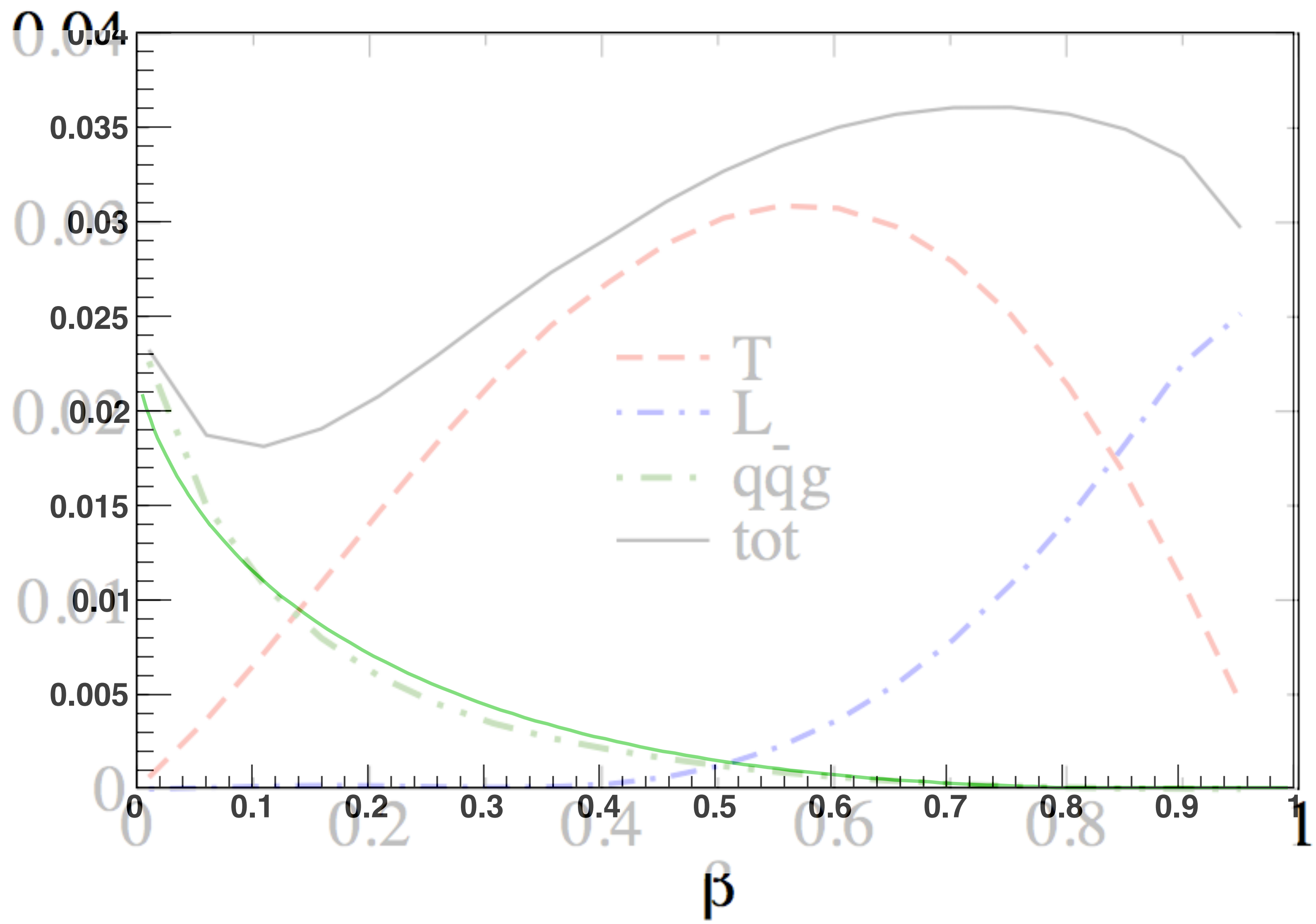


qqg-part two: GBW+MS

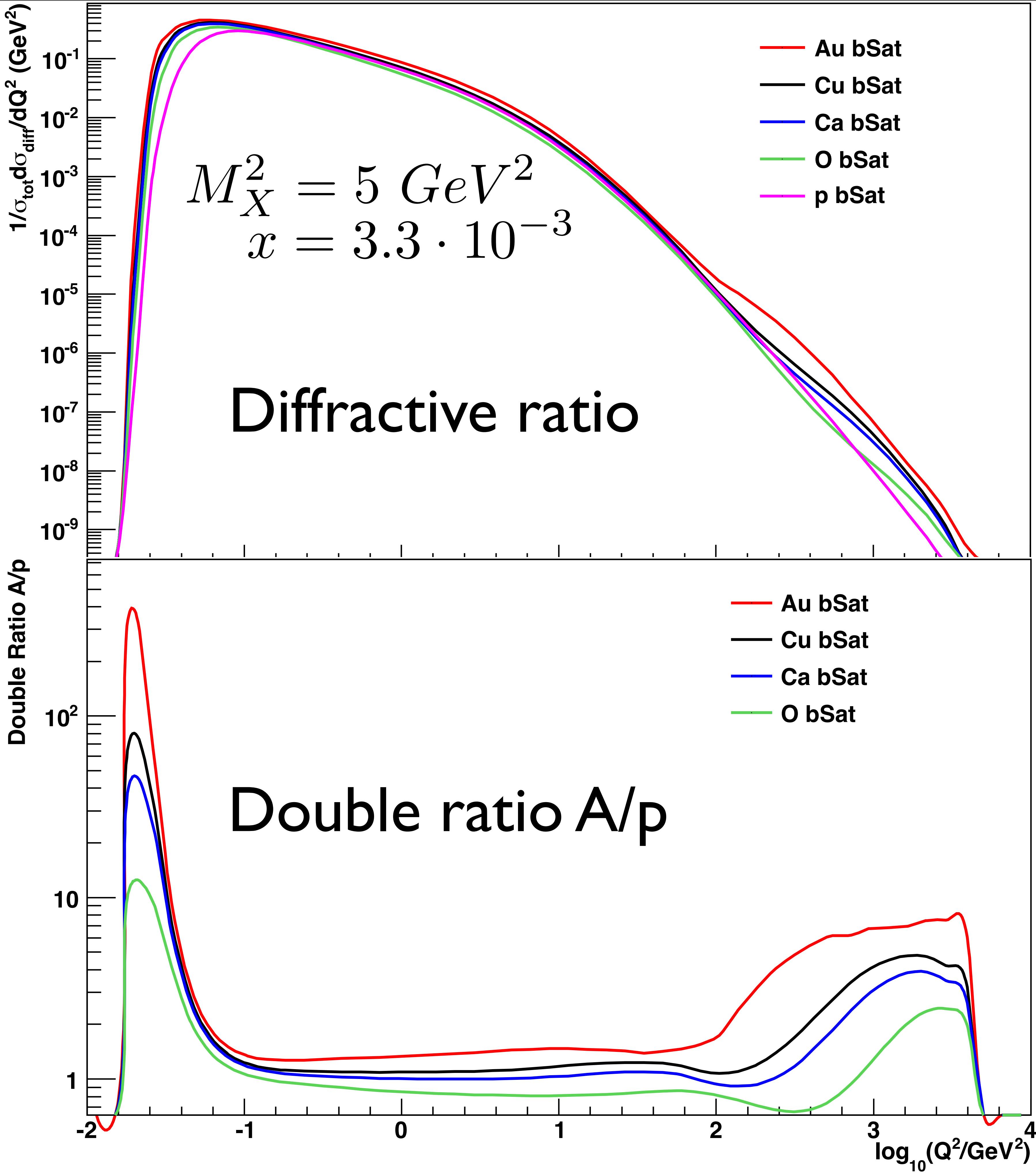
Solution: Use GBW with an extrapolation with MS

correct in limit β→0

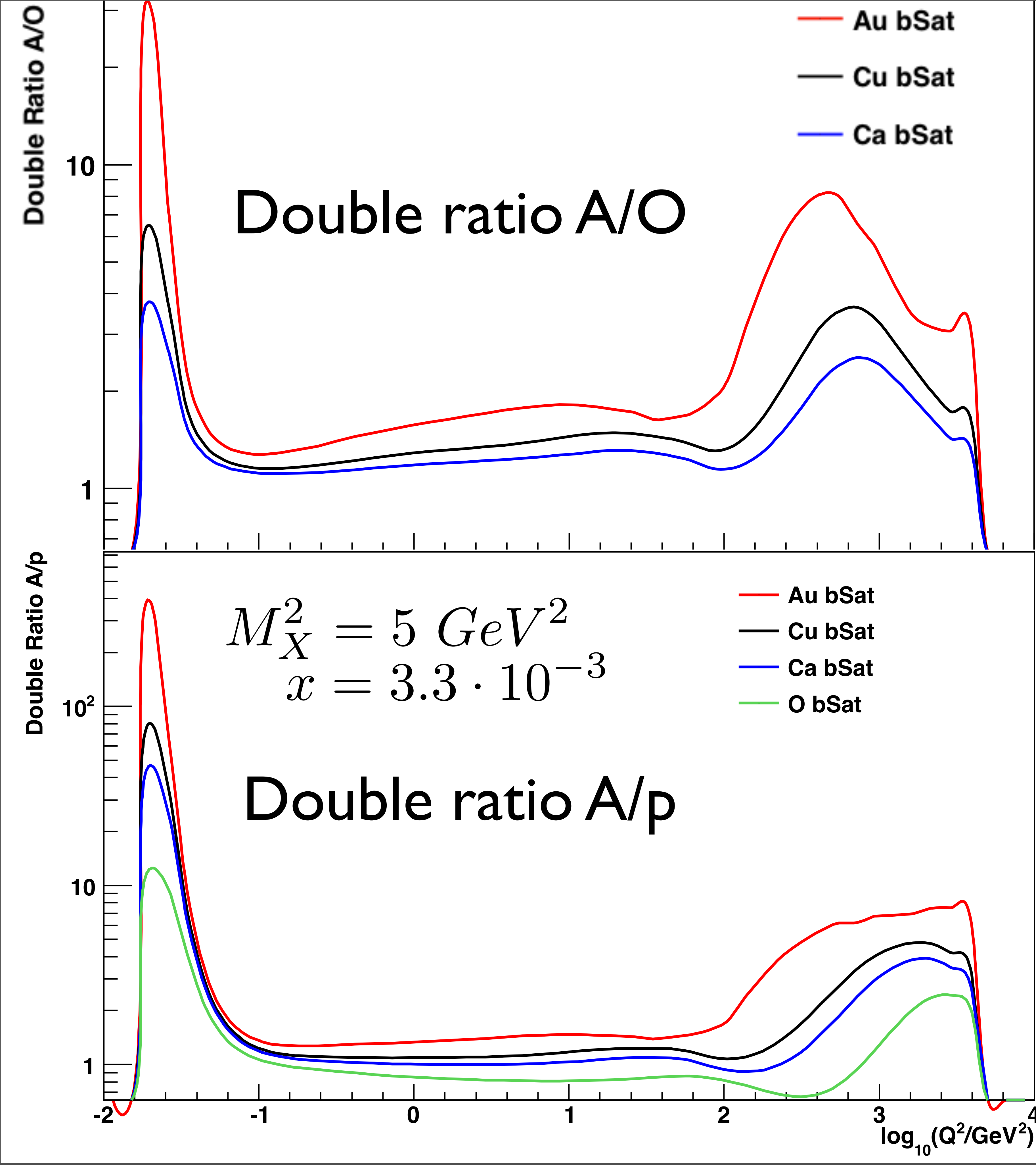
$$F^D_{T,q\bar{q}g}(x_{I\!P},\beta,Q^2) = F^{D\ (\mathrm{GBW})}_{T,q\bar{q}g}(x_{I\!P},\beta,Q^2)\,\frac{F^{D\ (\mathrm{MS})}_{T,q\bar{q}g}(x_{I\!P},Q^2)}{F^{D\ (\mathrm{GBW})}_{T,q\bar{q}g}(x_{I\!P},\beta=0,Q^2)}$$



The Q^2 plots

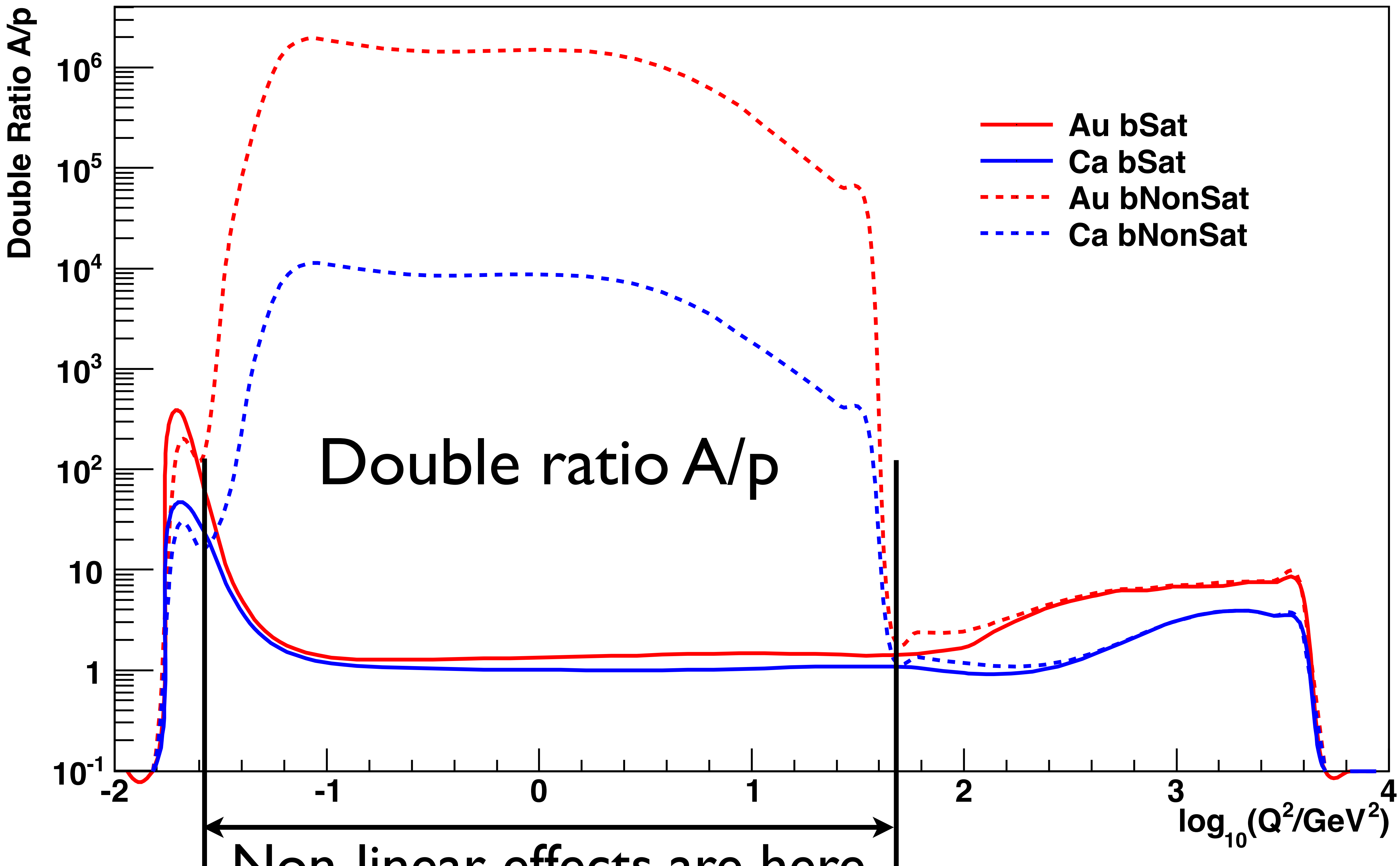


$M_X^2 = 5\ GeV^2$
$x = 3.3 \cdot 10^{-3}$
Diffractive ratio
Au bSat
Cu bSat
Ca bSat
O bSat
p bSat
1/σ_tot dσ_diff/dQ² (GeV²)
Double ratio A/p
Double Ratio A/p
log₁₀(Q²/GeV²)



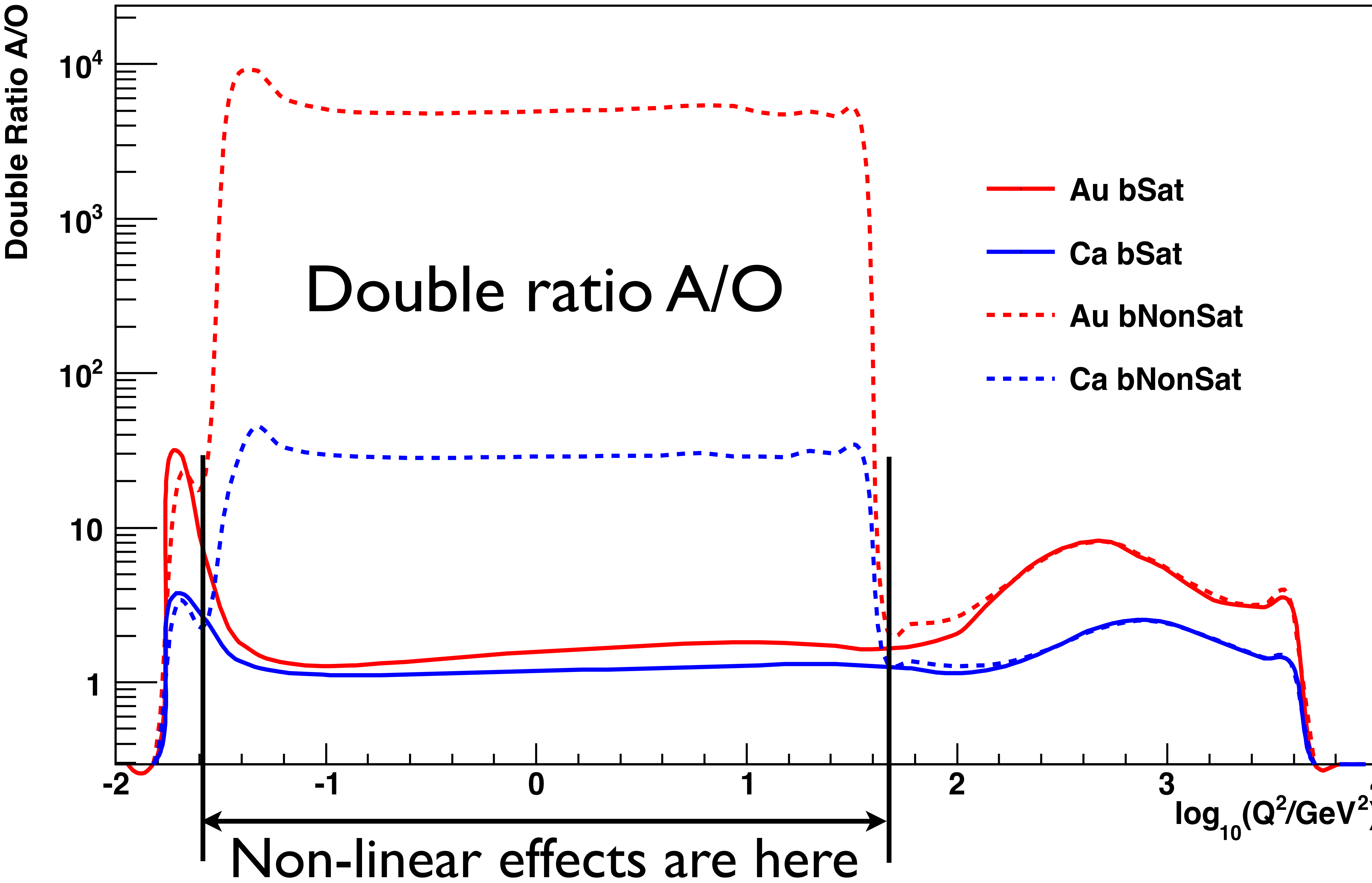
Ratio with oxygen:
Oxygen too light for saturation
Same geometry

Compare bNonSat



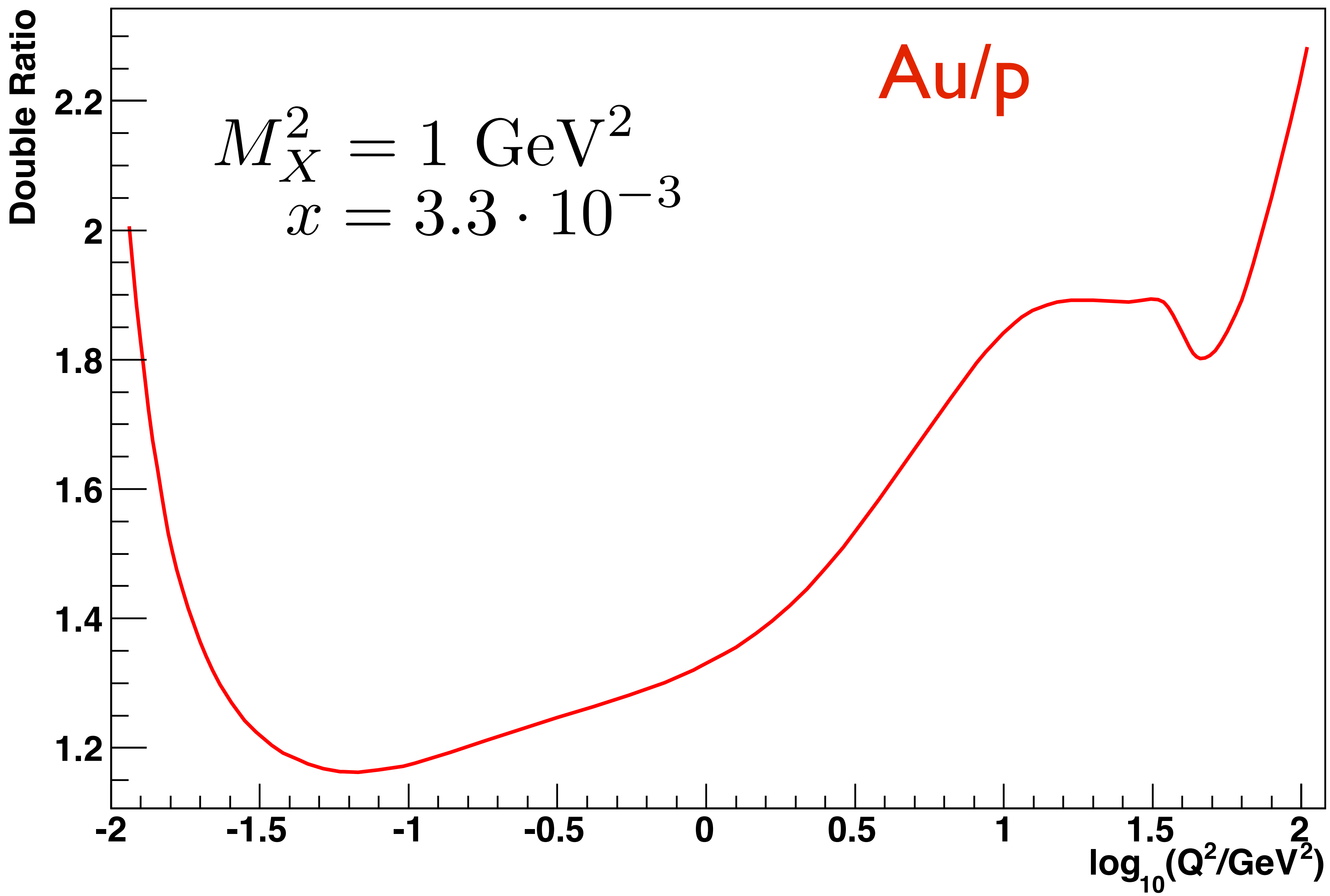
Small Q^2 ~ large r -> proportional to A

Compare bNonSat



Small Q^2 ~ large r -> proportional to A

$M_X^2 = 1\,GeV^2$



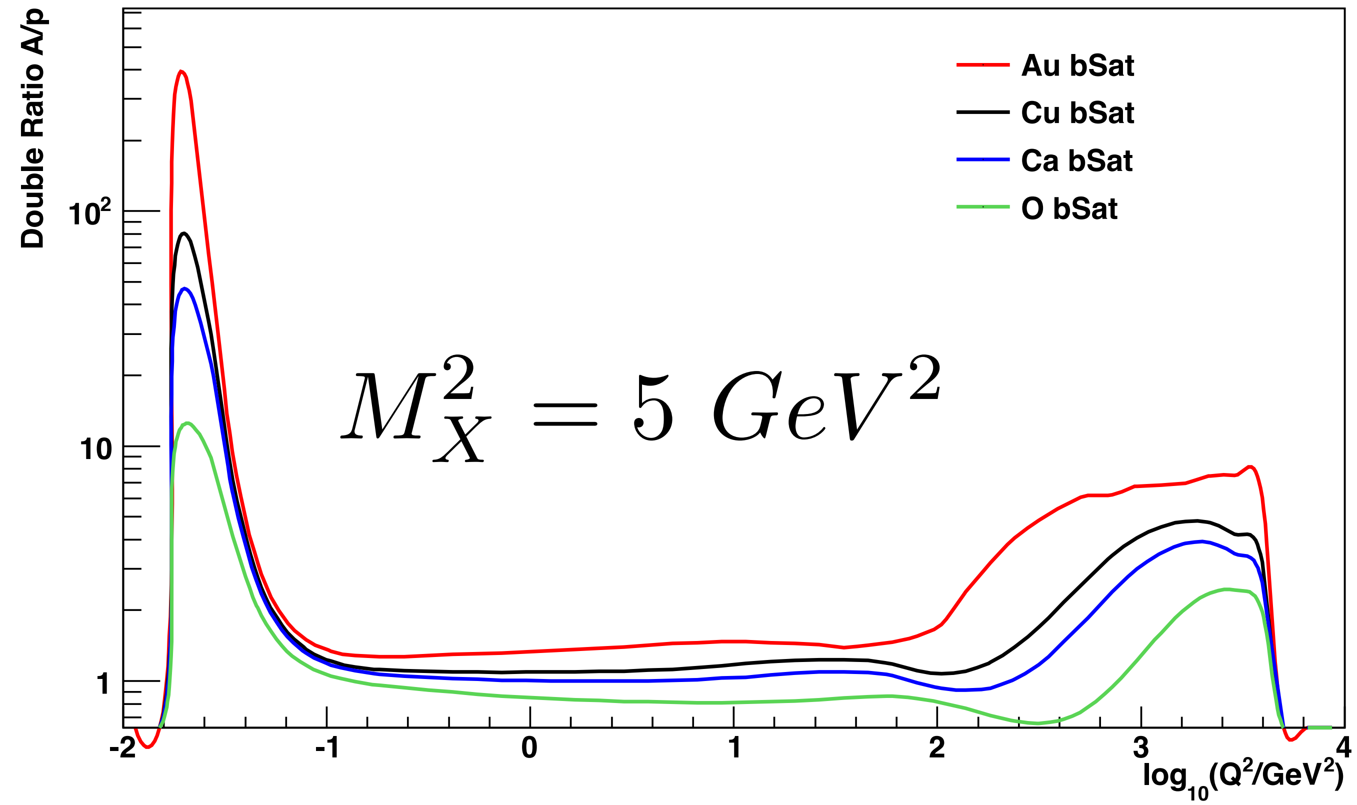
Au/p
$M_X^2 = 1\ \mathrm{GeV}^2$
$x = 3.3 \cdot 10^{-3}$
Double Ratio
2.2
2
1.8
1.6
1.4
1.2
-2
-1.5
-1
-0.5
0
0.5
1
1.5
2
$\log_{10}(Q^2/\mathrm{GeV}^2)$

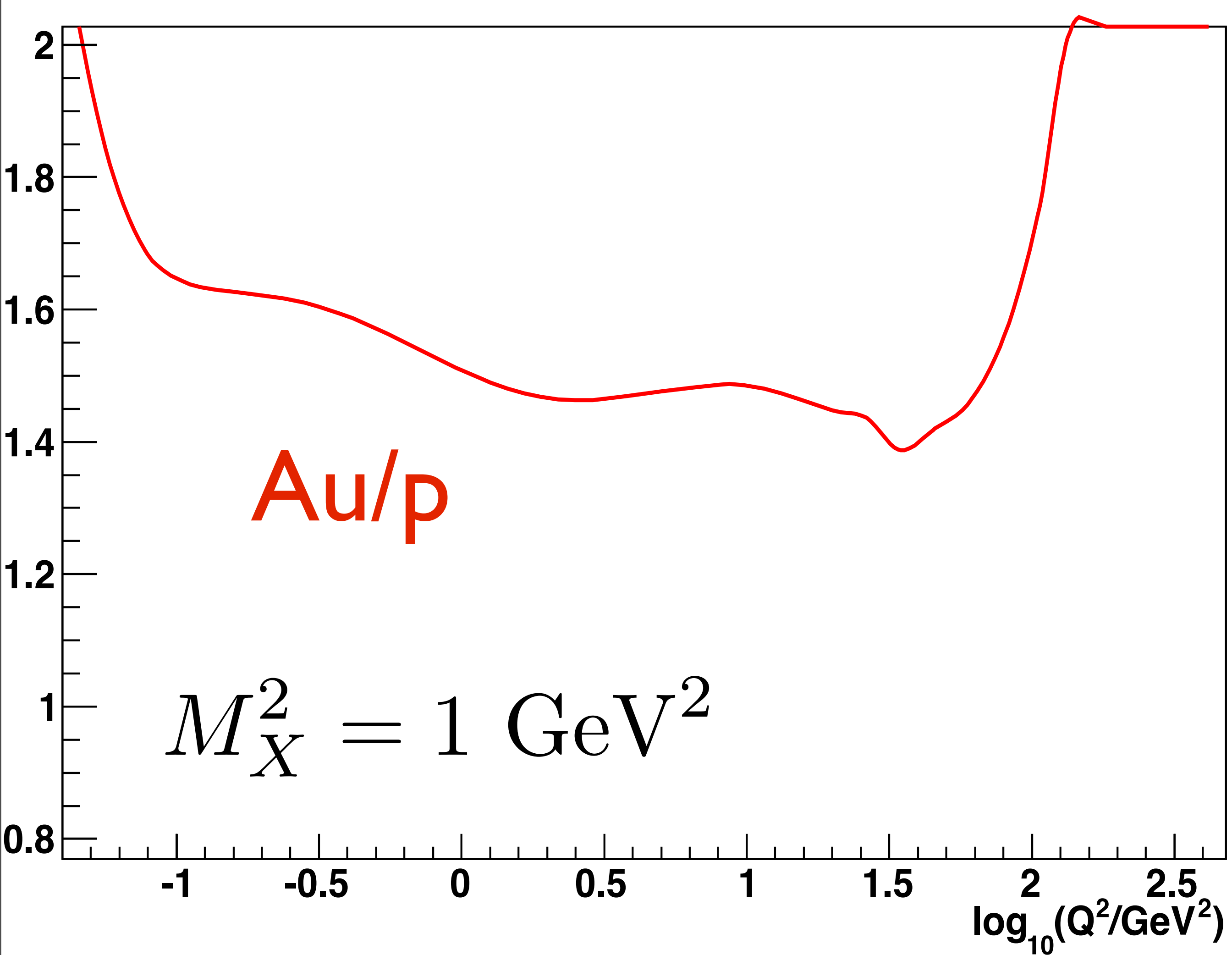
$M_X{}^2 = 1\,GeV^2$

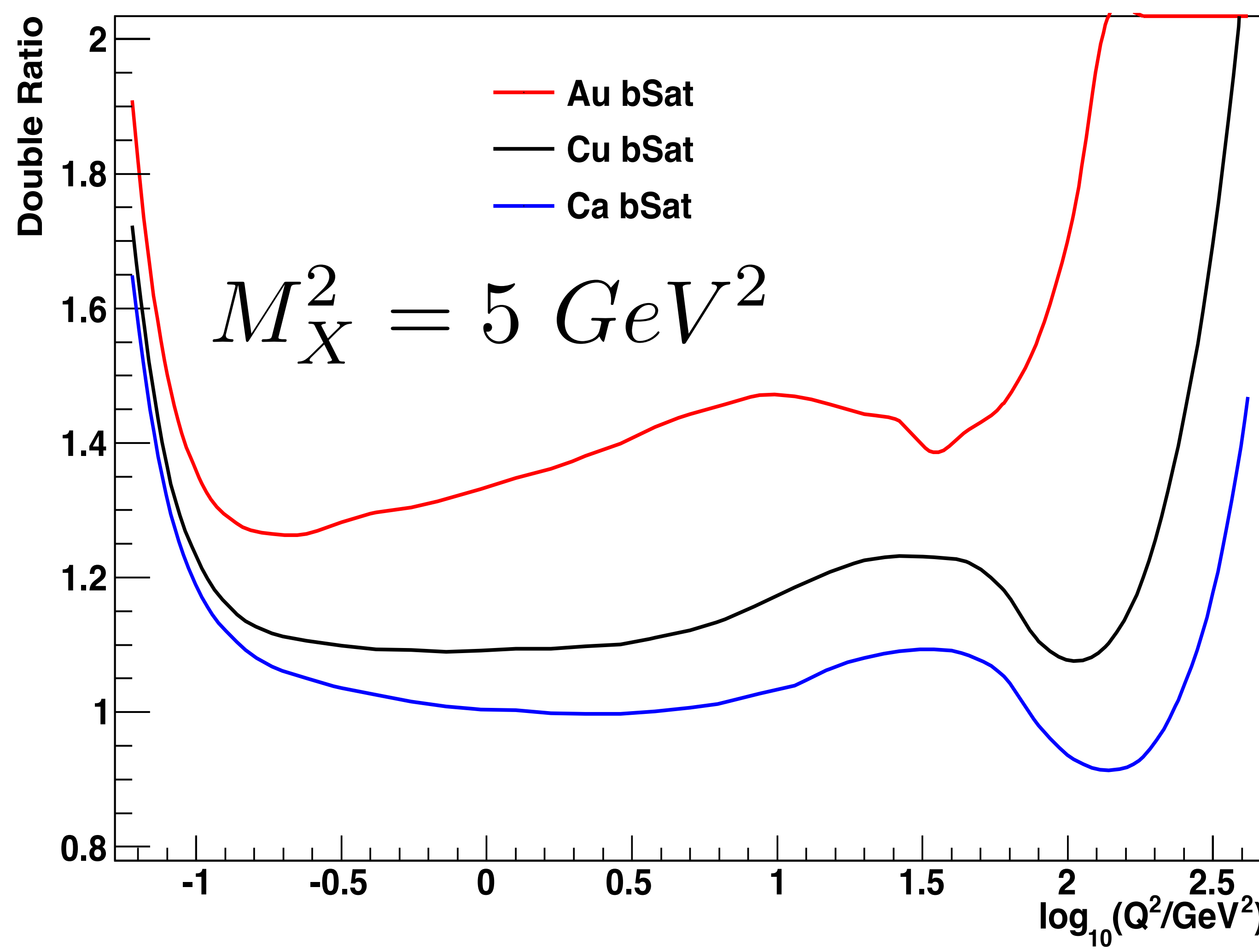
vs

$M_X{}^2 = 5\,GeV^2$

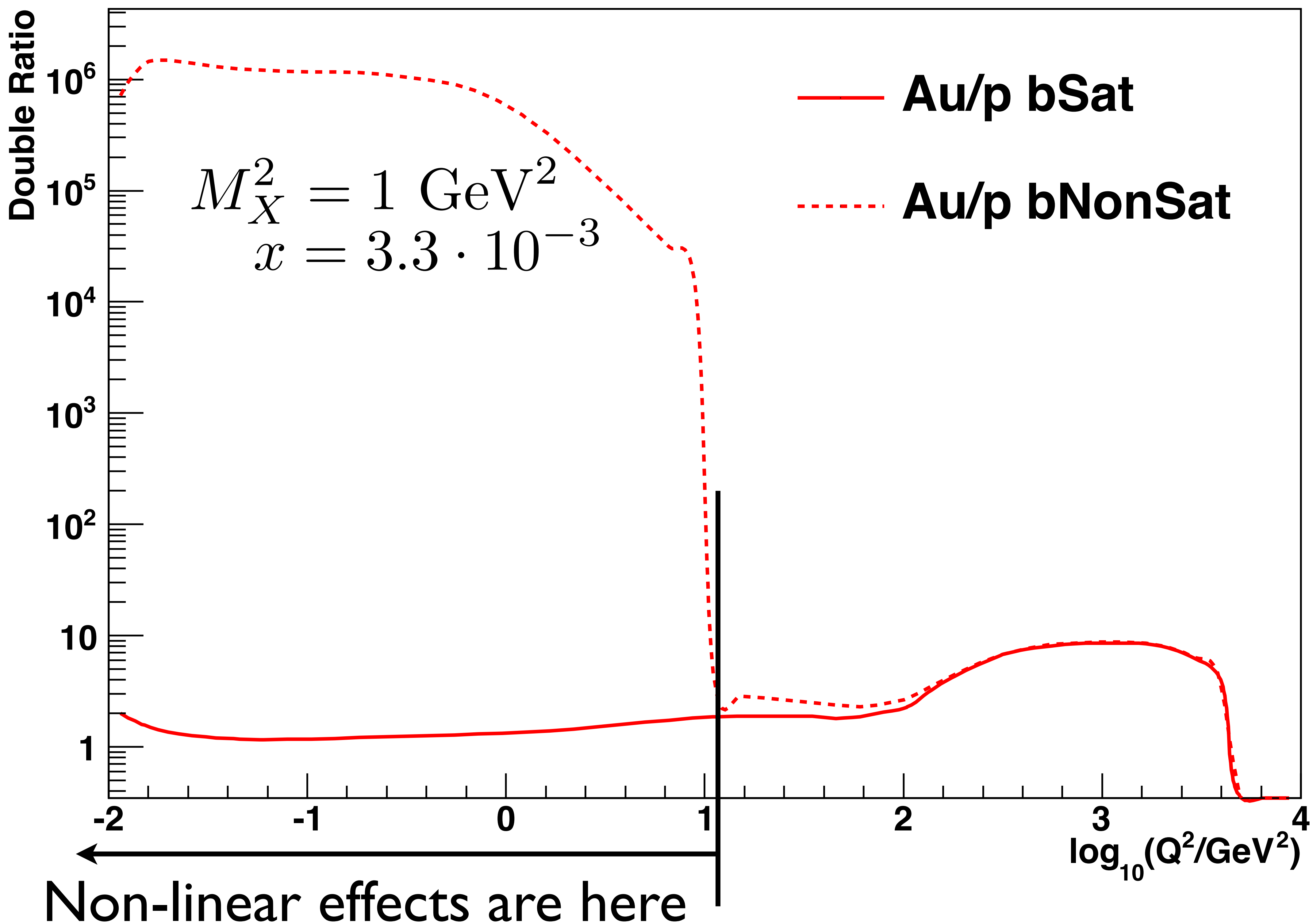
$x = 3.3 \cdot 10^{-3}$



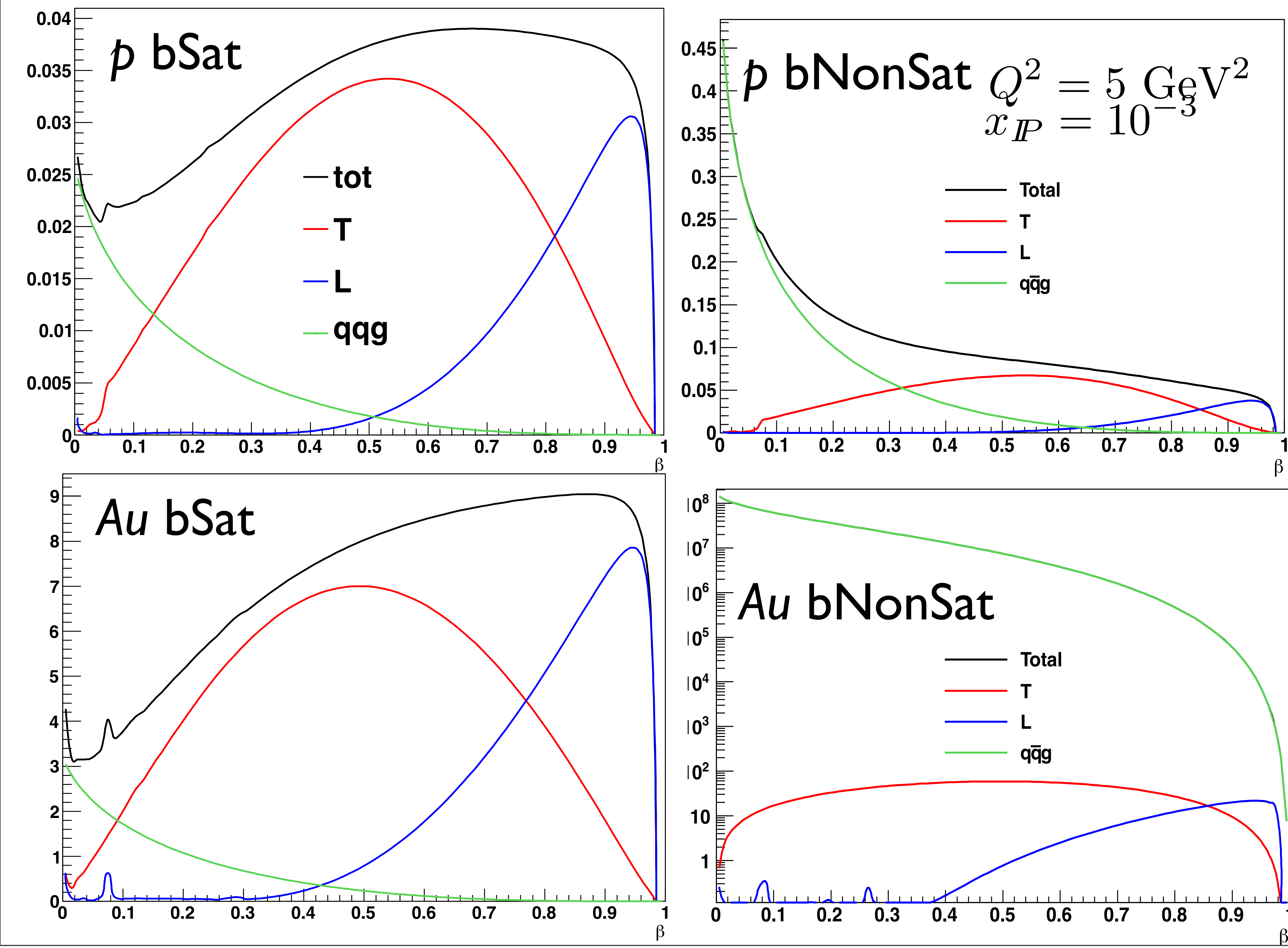




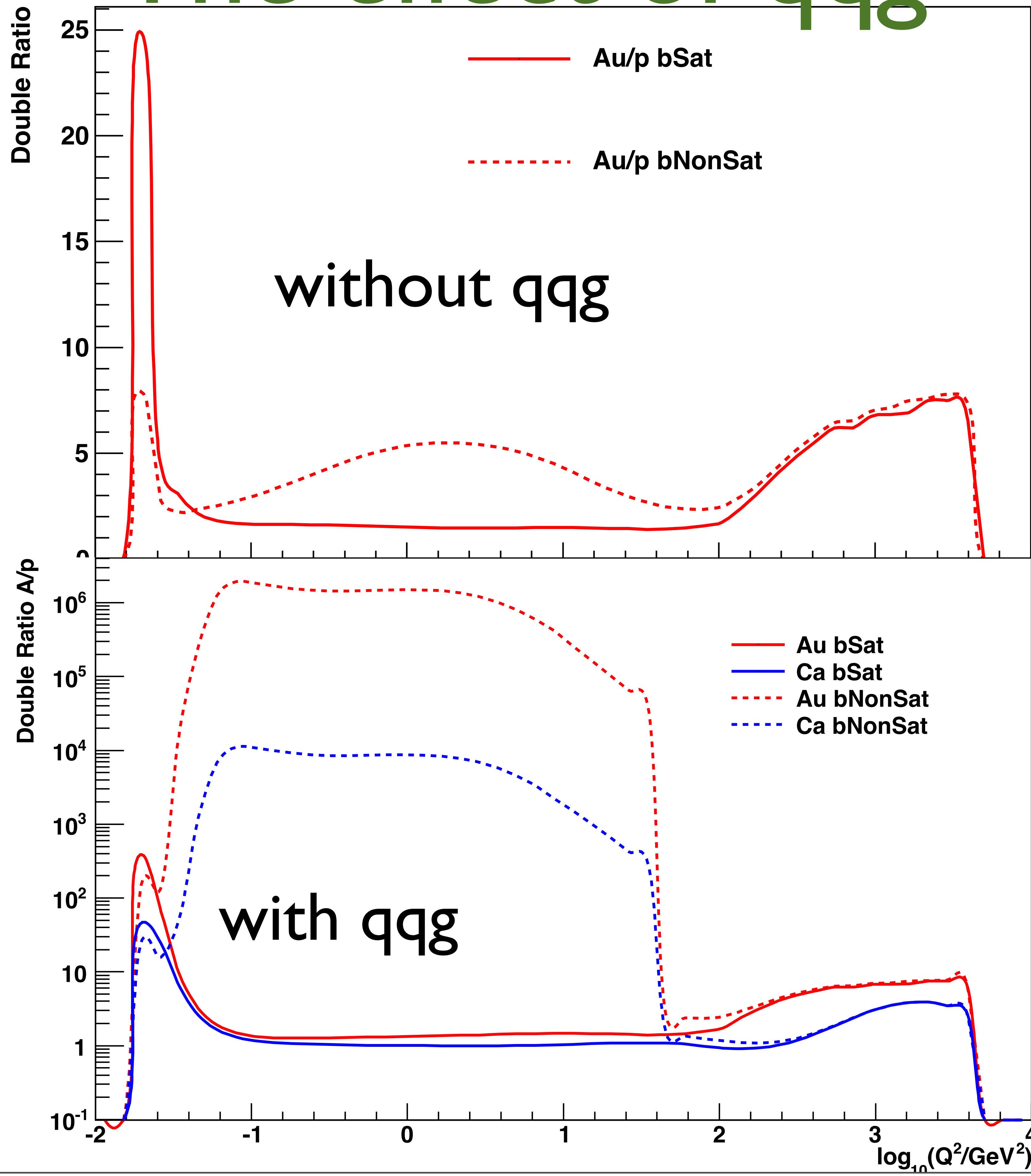
$M_X^2 = 1 \, GeV^2$


Double Ratio
10^6
10^5
10^4
10^3
10^2
10
1
-2
-1
0
1
2
3
4
$\log_{10}(Q^2/GeV^2)$
$M_X^2 = 1 \ \mathrm{GeV}^2$
$x = 3.3 \cdot 10^{-3}$
Au/p bSat
Au/p bNonSat
Non-linear effects are here

The effect of qqg


p bSat
tot
T
L
qqg
β
p bNonSat
$Q^2 = 5\ \mathrm{GeV}^2$
$x_{I\!P} = 10^{-3}$
Total
T
L
$q\bar{q}g$
β
Au bSat
β
Au bNonSat
Total
T
L
$q\bar{q}g$
β

The effect of qqg



$F_{2A}{}^D/AF_{2p}{}^D$

$$F_2^D = F_T^{q\bar{q}} + F_L^{q\bar{q}} + F_T^{q\bar{q}g}$$